A RING FOR HOLDING A LENS FOR DIP TREATMENT THEREOF

TECHNICAL FIELD TO WHICH THE INVENTION RELATES

The present invention relates in general to fabricating optical elements of organic material such as ophthalmic lenses for correction purposes and/or for sunglasses, and also lenses for instruments or optical precision instruments. The invention relates more precisely to treating the surface of such an element by depositing a coating layer by dipping the element in a bath of liquid, and it relates to a ring for use as an interface for holding the element for dipping purposes.

TECHNOLOGICAL BACKGROUND

In order to fabricate a lens, in particular an ophthalmic lens, it is conventional to form a transparent substrate by molding, thermoforming, and/or machining a synthetic resin or a mineral glass, and subsequently to deposit one or more coating layers imparting various optical or mechanical properties to the lens such as an ability to withstand impacts or abrasion, attenuating reflections, photochromy, etc. Thus, typically, the following are deposited in succession on at least one of the faces of an ophthalmic lens: a so-called primer layer; a hard layer providing resistance to abrasion; and finally an optional anti-reflection layer. The primer layer favors bonding of the hard layer and generally reinforces impact resistance. Primer layers and hard layers are generally constituted by varnish.

In industrial processes for fabricating lenses, and in particular ophthalmic lenses, these varnish layers are deposited by centrifuging or dipping in a bath of solution or by dispersing the varnish on the corresponding face of the substrate. When making use of dipping, the most inexpensive method, tooling is used that serves to hold the lens while it is being manipulated and in particular while it is immersed in the

treatment bath. Such holding tooling typically consists in an individual clamp having three branches engaging each lens on its edge face in three point or linear contact zones of its periphery, comprising two lateral contact zones and one bottom contact zone. In order to treat as many lenses as possible, the tooling may also consist in a "basket" capable of receiving a plurality of lenses simultaneously, and giving each of them the three above-mentioned bearing zones.

It is found that use of such tooling generates defects on the lens, which defects consist in the appearance of running and/or meniscuses of solidified varnish. Such meniscuses, in particular, consist in zones where the deposited material is too thick and they occur at the periphery at the points of contact between the lens and the tooling, penetrating radially several millimeters towards the center of the lens, thereby affecting the working portion thereof. These zones of extra thickness harm the quality of the coating, and more generally they harm the appearance and even the optical functions of the lens. Such local zones of extra thickness are particularly undesirable when depositing a thin layer that is to present uniform thickness, as applies in particular for so-called "quarter-wave" layers seeking to reduce the intensity of the optical phenomenon of interference fringes appearing at the interface between the substrate and the coating layer, and associated with them having different refractive indices.

OBJECT OF THE INVENTION

The main object of the present invention is to provide a holding accessory enabling a coating layer to be deposited on a lens by dipping, which layer is uniform in thickness and in particular is free from any peripheral zones of extra thickness.

A secondary object of the present invention is to ensure that the accessory as proposed in this way can be

used with existing clamping type or basket type tooling without requiring the tooling to be adapted.

To solve this problem, the invention provides a holding ring for holding an optical element for dip treatment thereof, the ring comprising a hoop for draining and encircling the edge of the optical element, forming an arc over more than 180° and provided at each of its two ends with an outwardly-directed drip tab.

The Applicant has designed and tested various contact shapes between the holding tooling and the lens. From that work, it can be seen that once contact generally in the form of a point exists between at the edge of the lens, then a running or extra thickness defect appears, in particular a defect of the meniscus type. That is why the proposed solution seeks to avoid the operation of dipping a contact of that type. The holding ring of the invention acts during said operation as a holding interface interposed between the lens for treatment and the tooling that serves to handle it. Because of its encircling hoop, the ring is clipped onto the lens for treatment by embracing the periphery of the lens and thus exerting continuous linear contact on said periphery. Since the ring is oriented in such a manner that the two drip tabs point downwards, symmetrically about a vertical midplane, the liquid coating material that is deposited during dipping runs over the faces of the lens, and at the periphery it runs along the encircling and draining hoop of the ring. The still-liquid vanish is then drained in channeled manner merely under the effect of gravity. At the two ends of the hoop, by pointing away from the lens, the drip tabs act to dispose of surface material flowing along the hoop, thus avoiding any accumulation of an extra thickness of material in contact with the lens.

It should also be observed that using the ring of the invention is particularly convenient since it suffices to engage the ring on the edge of the lens by

taking advantage of its opening and its own resilience so that it clamps like a bicycle clip for holding the trousers. The ring can then be gripped and manipulated together with the lens for treatment that it surrounds, in any manner and with any tooling, while avoiding any direct contact between the holding tooling and the lens. It is also of interest to emphasize at this point that the holding ring of the invention can be used merely in addition to pre-existing conventional holding tooling, thus making it possible to avoid the high cost that would arise if all the tooling currently in service were to be replaced.

According to an advantageous characteristic of the invention, the hoop presents an inside face in contact with the edge of the optical element, which inside face is longitudinally continuous to the second order. In other words, this inside contact face has no sharp edges extending across it, thereby encouraging varnish to flow longitudinally. The drip tabs then preferably present respective inside faces extending said hoop with longitudinal continuity to the second order. Also advantageously, and still to encourage drip drying, the free ends of the drip tabs are chamfered.

According to another advantageous characteristic of the invention, the hoop is made from a second member of section that presents an inside for coming into contact with the lens, an outside, and two lateral sides, at least one of the inside and the outside of the section of the hoop being set back and connecting to the lateral side via sharp angles. This shape facilitates the flow of varnish along the ring and serves in particular to provide a gutter or duct for the flow of liquid between the edge face of the lens and the concave inside face of the hoop.

According to another advantageous characteristic, the encircling hoop presents an outside face possessing two diametrically opposite striated portions making the

ring with its lens easier and more reliable to grip by means of a conventional type of clamp.

DESCRIPTION OF AN EMBODIMENT

Other characteristics and advantages of the invention appear on reading the following description of a particular embodiment, given by way of non-limiting example.

Reference is made to the accompanying drawings, in which;

· Figure 1 is a perspective view of a holding ring of the invention;

· Figure 2 is a plan view of the Figure 1 ring;

· Figure 3 is a section view on line III-III of Figure 2;

· Figure 4 is a perspective view of a holding ring in a variant embodiment of the invention;

· Figure 5 is a section view on V of figure 4;

· Figure ~~6~~5 is a perspective view showing an ophthalmic lens being gripped by means of conventional tooling plus the holding ring of Figure 4 in order to enable it to be treated by dipping.

With reference to the figures, and in particular Figure 1, the holding ring of the invention comprises a hoop 1 for encircling around the edge of a lens.

In this example the lens typically consists in an ophthalmic lens having a surface on which it is desired to deposit a layer of varnish, as is explained in greater detail below with reference to Figure 4.

The encircling hoop 1 is then for clipping around the lens against its edge surface. The hoop 1 does not form a complete circle, but presents an opening via which the ring can be clipped onto the optical element. The hoop 1 thus forms an arc of more than 180°, and preferably lies in the range 250° to 320°. In the particularly-optimized example shown, the hoop forms an

arc of 300° with an opening referenced Alpha~~α~~ in Figure 2 occupying 60°, to within 10%.

To perform this clip encircling engagement, the hoop 1 is made of a material that is elastically flexible. The stiffness of the material used needs to be the result of a compromise so as to ensure that the ring is secured reliably on the lens but without that stressing the lens. In testing, satisfactory results have been obtained with a hoop exerting a holding force on the lens of the order of a few newtons. In testing, with a lens having a diameter of 65 millimeters (mm), the force used has been in the range 3 newtons (N) to 8 N.

The material must also withstand the treatments to which it is going to be subjected together with the lenses on which it is to be fitted, and must remain inert relative to said treatments. In particular, it is necessary to find good mechanical behavior at high temperature without Young's modulus collapsing up to temperatures of about 100°C, and also good chemical resistance to hot basic solutions, alcohol solvents, ketone, etc. It is preferable for the melting temperature of the material to be greater than 150°C and for its glass transition temperature to be greater than -20°C. By way of example, it is effective to use polyamide 66 as the material constituting the ring, where polyamide 66 has a melting temperature of about 270°C, and a Young's modulus at ambient temperature of 2840 megapascals (MPa), or else to use polypropylene, which has a melting temperature of 180°C, a glass transition temperature of -10°C, and a Young's modulus of 1000 MPa to 1500 MPa at ambient temperature.

The encircling hoop 1 presents an inside face 2 that is to come into contact with the edge of the optical element, i.e. specifically the edge face of the lens. This inside face 2 is longitudinally continuous to the second order. It thus has no sharp edges crossing it, thereby encouraging varnish to flow longitudinally on

being extracted from the bath, as is explained in greater detail below.

In contrast, it can be seen that the hoop 1 presents outwardly and on its sides sharp longitudinal edges 3, 4, 5 in the form of circular arcs for the purpose of encouraging and channeling the flow of liquid material and thus improving the quality of drainage that is looked for on leaving the treatment bath.

More precisely, the inside face 2 of the hoop 1 is cylindrical and joins two flat flanks 8 via two edges 3 (only one of which is visible in Figures 1 and 2), which flanks join an outside face 9 made in the form of two convex portions, e.g. conical or toroidal portions, united by an edge 5 forming a crest line.

With reference to Figure 3, the encircling and draining hoop 1 is thus made from a section member of section presenting an inside corresponding to the inside face 2 that comes into contact with the optical element, and outside in the form of a triangular arch, corresponding to the outside face 9 and presenting an angular apex corresponding to the edge 5, and two lateral sides corresponding to the flanks 8 and connected to the inside and to the outside via pairs of angular points corresponding respectively to the edges 3 and 4. At rest, the neutral line of the hoop 1 presents the general shape of an arc of a circle.

At rest, the encircling hoop 1 possesses an inside diameter corresponding to the diameter of the inside face 2 referenced r in Figure 2, and an outside diameter, referenced R, corresponding to the diameter of the apex ridge 5. The center C_2 of the ridge 2 is offset downwards a little towards the opening α from the center C_5 of the edge 5. Since the edges 4 and 5 are concentric, the edge 3 meets the edge 4 tangentially. Specifically, in order to hold lenses that conventionally have a diameter of 65 mm, the following values have been used: r = 28.5 mm and R = 32.5 mm.

At each of the two free ends of the encircling hoop 1, the ring is also provided with a respective outwardly-directed drip tab 10.

Each drip tab presents an inside face extending the inside face of the encircling hoop 1 with longitudinal continuity to the second order.

As can be seen more clearly in Figure 2, the free ends of the drip tabs are chamfered so as to make it easier for drips of material to be removed under gravity. In the example shown, the end chamfers formed in this way leave between them a dihedral presenting an angle at the apex equal to the opening angle α.

Figures 4 and 5 show a variant embodiment of a ring of the invention. As above, this ring comprises an open hoop 20 provided at its free ends with downwardly-pointing drip tabs 30.

In this variant, the hoop 20 possesses inside and outside faces 21 and 27 that are concave and flanks 25 that are flat. More precisely, and as can be seen more clearly in Figure 5, the inside of the section of the hoop 20, corresponding to the inside face 21, is in the form of a circularly arcuate setback and joins the lateral sides corresponding to the flank 25 directly via sharp angles. The outside of the section of the hoop 20, corresponding to its outside face 27, has a main central portion in the form of a circularly arcuate setback, and it joins the lateral sides 25 via two flats 26 forming sharp angles 23, 24 with the lateral sides 25 and with the central portion.

The outside face of the encircling hoop possesses two striated holding portions 31 that are diametrically opposite and generally situated on the horizontal diameter of the hoop 20.

In operation, as shown in Figure 6, tooling is used for holding the lenses 100 while they are being manipulated, and in particular while they are being immersed in the treatment bath. This holding tooling is

of conventional type and consists in this example and in typical manner of a basket 200 capable of receiving a plurality of lenses 100 simultaneously and providing each of them with three bearing zones, comprising two lateral grip zones and one bottom bearing zone.

Each lens 100 is previously provided with a holding ring such as the ring 20 described above.

To receive each lens 100, the basket 200 has a clamp with two branches 201, 202 gripping the ring 20 of each lens 100 via its outside face, its striated portions 31 co-operating by providing a grip for angled claws 203, 204 formed at the ends of the clamp branches 201, 202. A plinth 205 provides a direct bearing point for the edge face of the lens 100 in its bottom portion.